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Since its foundation, the success of the Ottoman state depended on its ability to track technological developments among its eastern and western neighbours, and to transfer promptly those which met its needs. Until the 19th century military requirements prevailed, and the choice and speed of the transfers were largely determined by the army and the political authority. In the transfers of the 19th century, which were particularly accelerated after 1830, these military and political requirements competed with the growing needs of the people. In contrast to the previous period, imported innovations changed the basic structure of society, and were felt at the individual level by an acceleration in the pace of daily life and the acquisition of free time in every field of production.

There is a famous anecdote of the period. A European tells a Chinese that the railroad linking Shanghai to Peking will reduce travel time from a month to a day. His reaction is easily understandable under the conditions of the century : "Then, what will we be doing in the remaining 29 days?" The same question could be attributed to an Ottoman of the period.

In the 19th century, Ottoman lands spread across three continents (Europe, Asia and Africa), and were divided by large seas (Mediterranean, Red Sea, Aegean, Persian Gulf, Sea of Marmara, Black Sea). The area of lands and seas together covered 10 million km², and the lands alone at the beginning of the century stretched over 7.5 million km². Between 1827 and 1885 the Sublime Porte lost nearly one third of this land. The remoteness of the provinces to the capital Istanbul limited the application of the new technologies with the same efficiency and density everywhere. Consider some straightline measures : from Istanbul to Yemen was 4,300 km, to the Austrian border 1,000 km, to Kuwait 2,800 km, to Algeria 5,000 km, to the Caucasian border 1,250 km. Some of the provinces being very mountainous and others desert regions, or separated by sea, communication and correspondence were often difficult.

It is in this context that we must consider the effects of the new communication technologies on Ottoman society. In the 17th century, the army crossed from Istanbul to Damascus (1,300 km in straight line) with all its effects in 78 days. In the same period Evliya Çelebi made the identical journey in ten

days on horseback without any rest. When the railroad was completed at the turn of the 20th century, it took 3 days for any passengers and materials. In the 1820s the journey between Istanbul and Tiflis (1,300 km) required 45–50 days for civilians. An official messenger was able to make it in 17 days. In the 1750s, the road which linked Istanbul to Vienna, i. e., the European connection by land, was crossed in 20 days by special post couriers. New technologies reduced it to 5 days in the 1850s and to 2.5 days in 1888 when the railroad connected the two cities.

We must also consider population density. Averaged over the whole empire, the density amounted to only 4 persons per km²; in the Balkans and Western Anatolia it reached 15 per km² –a figure still very much under European averages. On nearly the same surface of land, China had twenty times the population. Consequently it simply wasn't possible to bring new public utilities with the same concentration to every corner. It must be remembered that in those areas where nomads were in the majority, the new technologies contributed little to the welfare of the population; on the contrary, they upset traditional social patterns, and so met with much resistance. And this impeded the equal distribution of the services.

Finally, we also have to add the financial bankruptcy of the Ottoman state, which obliged it to give preference in its investments to areas of higher profitability.

Radical changes in Ottoman structures started in the second half of Sultan Mahmud II's reign (1808–1839). Before the wholesale introduction of new western technologies, Ottoman reformers first attempted to modernize already existing communication and transportation systems according to western concepts.

Roads

The first development in the field of transportation was the use of horsedrawn cars. This necessitated the amelioration of road conditions as well as their diffusion over areas beyond the traditional army and caravan roads. The existence of bridges on the main rivers facilitated the undertaking. By 1850 new projects suitable for spring-carriages, as Bursa–Mudanya, Bursa–Gemlik, and Trabzon–Erzurum began with the assistance of Western technicians. The lengthiness of these early attempts and their excessive cost compelled the state to search for new methods of road construction. In the new European model, the population was called upon to contribute materials and money.

The 1869 *Regulation on roads and passages* created a state administration responsible for all construction. Roads were categorized in four groups as in

Europe. For each group the width, obliquity conditions, and construction techniques were defined. In 1873–74 the School of Roads and Passages began to train the necessary technicians. In 1889, the McAdam road construction techniques, which were used even earlier, were definitively adopted for all constructions. During the Abdulhamid II's reign (1878–1908), a bill and a map containing all the projected roads were prepared for the first time. Taking land, rail, and sea connections into consideration, the plan called for 4,176 km of highways (2,567 in the European, and 1609 in the Asian lands) and 275,000 km of secondary roads. In 1895 there existed nearly 14,500 km of carriageways in the empire, and 7,515 km were projected for immediate construction.

Postal services

The amelioration of the transportation system, coupled with rail and sea transport, which we will examine later, necessarily had its impact on communications. The old Courier–Station system (*Ulak–Menzil*) served the state's need for information by employing messengers with relays of horses. The system worked perfectly for centuries, but came to seem inefficient with time. Furthermore it contributed nothing to the private sector. The institution was reorganized on October 23, 1840 as the Ministry of Postal Services with the aim of serving both the state and the population at large. It thus very much influenced economic relations. By the end of the 19th century, post-offices existed even in the most remote parts of the country. Anybody could use their service by paying the necessary fees. A firman of January 13, 1863 replaced the payment of fees with the use of postage stamps. The administration progressed quickly and soon reached Western standards. It participated in the International Postal Conference at Bern in 1874, and contributed to the creation in 1878 of the World Postal Union.

Steamship technology

The first technological novelty transferred from the West in the field of transportation was steamship technology, which was also important militarily.

Soon after the 1810s, when Europe started to use steam power in ships, the first vessel began operating in Istanbul (1827). Due to its speed and resistance to the atmospheric conditions, interest in the new invention grew quickly. The first steamship was constructed in the Istanbul dockyard in 1838 under the supervision of an American expert. In 1844 scheduled services began between the Marmara Sea ports for the transportation of men and materials. Soon the need was felt for trained staff, and students were sent to Europe. In the 1860s, the ships constructed at the *Tersane-i Amire* (State dockyard) began scheduled

services in the high seas, from Istanbul to Izmir, Salonica, Crete and Alexandria.

After the Crimean War (1853–56), the geopolitics of the Ottoman state obliged her to take into consideration the threat and rivalry of neighbouring sea powers like Britain, France, and Russia. This forced her particularly to equip the navy with the most sophisticated warships of the period. The construction of steamships in Istanbul with engines brought from Europe was abandoned by the end of the century, as it became cheaper to buy ships directly from the West. On the other hand, the use of steamships completely changed the character of sea transportation in ports like Istanbul and Izmir, which relied heavily on boats. The introduction of scheduled steamship service in the Bosphorus also initiated a new way of life in the empire's capital.

The appearance of bigger ships, as well as the increase in the trade volume, created the need for modern and larger quays and warehouses. Istanbul, Salonica, Izmir, Derince and Beirut were the first cities to be equipped with such complexes. The modernization of the ports encouraged the construction of roads connecting them to the hinterland.

Railroad transportation

In 1839, only fourteen years after the beginning of commercial railroad transportation in Europe, the first railway project was conceived in Ottoman lands. It aimed to connect Costanza to Tchernova (in present day Romania). The first attempt failed because of Russia's obstruction, but the project was renewed in 1857 through the initiative of a British group. In this way, the first Ottoman railroad of 64 km began operation in 1860. The second one in European Turkey, the Varna–Rustchuk railway (in present day Bulgaria) of 224 km, was completed in 1868.

The importance of railways particularly for commercial transport, as well as for the easy transfer of military units, stimulated interest in them. The idea of uniting Europe to the capital Istanbul gained ground among Ottoman statesmen. After Sultan Abdulaziz's journey through Europe in 1867, the first of its kind among eastern rulers, and one accomplished mainly on steamships and trains, railways became the main passion of the Sublime Porte. The concession of the construction of 2,000 km of tracks in European Turkey was granted to an Austrian contractor. Works began in 1870 and the first 1,179 km was completed in 1875. Then the company's structure was changed, and it became more interested in the commercial exploitation of existing lines than in continued construction. The cost became a major burden on the state's budget, and was one of the chief reasons for its bankruptcy.

The fate of railway projects in Asiatic Turkey was not very different.

Because of the foreign contractor's corruption, constructions could not be finished. The first railway in Anatolia was installed between Izmir and Aydın, two important economic and commercial centers. The construction permit was granted to a British company in 1856, and a 130 km long line was completed only in 1865. Later, between 1885 and 1896, some branchlines were extended to Alaşehir, Soma and Afyon. In this way a real railway network was created in the Aegean hinterland, totalling 520 km of tracks. Another short line (67 km.) connected the Adana plain to the port of Mersin in 1886.

The various problems with the foreign contractors compelled the Sublime Porte to undertake the constructions itself. The Mudanya-Bursa and Haydarpaşa-Izmit lines were the first fruits of this decision. Work started on them in 1871 was completed by 1873. The state undertook their commercial management until 1880, but without success, and it later transferred control to foreign companies.

In the last decade of the 19th century, railway concessions for Asiatic Turkey became the subject of a bellicose rivalry between imperialist powers, i.e., Britain, France, Russia and Germany. Each one blocked investment by the others in areas under its sphere of influence. In spite of such obstacles railway construction continued. In the last years of the century, tracks reached Konya and Ankara in the middle of Anatolia, and important projects as connections to Baghdad and Syria were prepared.

The best example of the efficiency of technology transfer to Ottoman society was the realization of the Hedjaz Hamidiye Railway. Planned and executed between 1900 and 1908, it was a pure Ottoman product from every angle — financing, technology and construction. The capital was totally Ottoman with some donations from Muslims all over the world. Except for a very limited number of foreign experts, most of the technical staff were Turks. When the connection between Istanbul and Damascus was nearly finished, work started from Damascus and a line of more than 1,500 km reached Medina in Hedjaz in six years time—an achievement hailed even by the westerners as an “appreciable speed”. It not only provided comfortable travel for pilgrims and served military aims, but also advanced the commercial, agricultural, industrial and cultural development of the provinces it crossed. Praised by foreign observers for “its solid construction, the conception of the line and the installations for the exploitation,” its cost per km was half of the amount demanded by foreign contractors.

Communications

The first innovation in this field which was transferred from the West and

found a large area of application was the telegraph. It was exhibited by an American in Istanbul in 1847. Some years after it appeared in Europe, the first line was built on Ottoman lands during the Crimean War. On August 22, 1855 the first telegraphic message was transmitted within the empire, and on September 14th of the same year Europe learned by telegram of the victory of Sebastopol. Lines spread very quickly all over the country. Ten years later, in 1865, a telegram sent from India reached Baghdad on the same day, and from there was transmitted to Istanbul and Europe. The Ottoman system thus became an important link in world communications.

Very soon there remained no place without a telegraphic connection in the European as well as Asiatic parts of the empire. In 1869, telegraphic lines stretched 25,137 km long (most with double or triple wires), and were extended to 36,640 km by 1904. The use of the telegraph as a means of communication rose impressively. From a total number of 960,250 messages sent in 1869, the number reached 5.5 million by 1904. The importance of the role played by the telegraph in the Ottoman society can be evaluated, half a century after its start in the first years of the 20th century, by its effect on popular behavior both in European and Asiatic lands. Crowds often occupied the telegraph offices and communicated their grievances and demands directly to the Sublime Porte, even to the palace of the sultan. The reestablishment of the constitution in 1908, which had been suspended for 30 years, was also the result of revolutionary messages reaching the government by telegrams.

As in the case of the railway technology, in the beginning nearly all the staff managing the telegraph were foreigners. But by 1860 a school was opened for the training of local technicians.

Telephone

Another technological novelty was the telephone. Just five years after its invention in the West, it was used in 1886 between two post offices in Istanbul. Then it spread immediately to all the post and telegraph offices, banks and ports. Most, however, were suppressed by an order from the sultan, who feared its use for terrorist activities. This slowed development until the proclamation of the second constitution in 1908.

Airships

Ottoman society prided itself for having an inventor who already in the mid-17th century successfully flew several kilometers over the Bosphorus with artificial wings. Unfortunately, his efforts weren't followed up. In 1801-1803 and 1825 there were some attempted flights by local people with dirigible

balloons. Western technicians made some demonstrations in 1844, 1859, and 1871. Real interest in planes, however, appeared after the second constitution. The first plane was bought in 1912, and pilots began training for military purposes.

General evaluation

Ottoman administrators became aware of the backwardness of their transportation and communication systems for the first time in the 18th century, in the field of ship construction. A serious move towards overcoming the deficiency in existing technologies was undertaken with tin 1773, with the installation of *Mühendishane-i Bahri-i Hümayun* (Imperial School of Naval Engineering) after the total destruction of the Ottoman fleet by the Russians in 1770. Assisted by the Hungarian-born French military expert Baron de Tott, the government sought both the transfer of modern knowledge as well as the modernization of the shipyard.

This new initiative was hindered by the political events of the following decades. The reactionary revolt of Janissaries in 1807, which caused the postponement of the reforms, as well as the political happenings between 1820 and 1832 (the Greek war of independence, destruction of the Janissary corps, destruction of the Ottoman fleet by the British–French–Russian coalition, defeat in war by Russia, defeat in war by the armies of the governor of Egypt) all slowed the pace of progress. It should be noted, too, that the personnel educated in this school was not intended for the private sector, but only for state service. Their interest was thus directed toward keeping the fleet in action, rather than perfecting technologies or advancing research.

When the steamships made their appearance in Europe, it was again only the state which became interested with it. In 1827 the Sublime Porte purchased the first ship, and eleven years after undertook to construct one in the Istanbul shipyard. The real aim was not commercial, but purely military and strategic; the goal was to recover control over the eastern and middle Mediterranean, lost to Europe after a sovereignty of three centuries. The Ottoman private commercial fleet was composed of small vessels, and political events hindered their renovation. With larger and quicker steamships, Europeans and even Americans (who first arrived in the Ottoman seas in 1797) monopolized the greater part of the eastern commercial transportation. Not only external lines, but also regular services between Ottoman ports were practically submitted to the control of the British, French, Austrian and other European countries. Encouraged by Ottoman capitulations, they had no worries about rivalry from the local private sector.

At this stage, the administration noticed the inadequacy of school training limited to theory, and decided that the solution lay in the indigenous construction of steamships. On the one hand, the Imperial School of Naval Engineering was ameliorated ; on the other hand, the government decided at the same time to send students to Europe to study ship construction, steam engines, coal production and iron casting. The purchase of four steamships was also proposed. As so often happens in bureaucracies, discussions dragged on, lasting to 1842. Some pointed out that the purchase of only ships would not solve the problem, and that it would be more opportune instead to import “factory machines” to be used in their construction. Others remarked that the iron production in the country was insufficient and had to be perfected before other things. At last it was decided to begin by installing an iron factory, and to give up the purchase of all ships.

In the meantime, the state shipyard was modernized. However, the success in building ships could not be repeated in the production of steam engines. Much turned on the financial limitations of the Ottoman state budget. The search for sources was the real cause of the prolongation of the discussions and the delay in the application of new technologies. On the other hand, the structure of local private capital did not permit its interference to this field. There was no tradition of industrial investments on such a scale, and a capital market didn't exist. Although the state started in early 19th century to appoint and back some privileged local businessmen trading with Europe (*Hayriye tüccarları*), this effort to create capitalists could not bear fruit in a short time. As the state's interests were focused on political concerns, the field was left to foreign capital. A famous Ottoman historian of the period, Ahmed Cevdet Pasha, noted at the last quarter of the century :

Although perfect ships were constructed, it was forgotten that a commercial navy serves as the nursery-garden of the military fleet. And no effort was devoted to developing commerce.

The investment needs of the Sublime Porte were not limited to ship construction. Military investments embraced the largest part of the budget. In communication and transportation, there was also the need for roads, railways, and telegraph lines. Necessarily the government was forced to avoid investments that were not immediately commercial and profitable investments, and to search cheaper formulas, such as buying ready-made steam engines. This left the state at the mercy of foreign capital. It must be remembered that the Ottoman economic structure, in which the main financial transactions lay under

the control of the state, was abolished in 1838 by the commercial treaty with England. This treaty was copied by all the other states of Europe, expanding the range of capitulations. In this way, European capital came to control more and more of the Ottoman market, and even created its own stock exchange market in Ottoman lands. The Crimean War (1853–56) increased the state's need for cash. Thus the only state in Europe that until then had not contracted any loans started to borrow money. Ottoman administrators, who were absolutely ignorant of the rules of the capitalist market, could not prevent the corrupt tactics of the creditors, nor were they able to stem their own luxurious spending. This too drained money away from technology producing investments. Indeed, only twenty years after the first loan in 1875, the state became incapable even of paying the interest on their debts, and declared bankruptcy.

Competition among European investors also impeded the introduction of basic technologies. Each preferred to keep Turkey dependent on its own suppliers. They sought to maintain the country as a market for their products, which would export only raw materials for their industries.

It would be an error to think that the technologies introduced mainly for military and political purposes, did not influence the civil and private sector. The transfer of technologies in the fields of transportation and communication in fact greatly helped the transformation of the Ottoman society from a military to a more civilian structure.

Foreign technicians were first used in 1838 in the construction of steamships, in 1850 in road construction, in 1855 for the telegraph and in 1857 for railroad construction. In the second and latest third quarter of the 19th century, modern regulations were prepared and modern schools installed to train specialists in each of these areas. All this made for impressive change. Those who were educated in this first stage remained mainly technicians more than researchers. A few tried to renew or perfect the technologies, and even received praise from Europe, but they were unable to compete with the speed and density of the innovations introduced from the West. Each new technology rendered their efforts useless, as structures for basic research didn't exist. This is why their success is more manifest in labour-intensive fields which do not need special expertise, like road and railway construction. The existence of cheap manpower (mainly soldiers) encouraged those projects. Changes in the energy sources for transport from animal to steam, to compressed air, gas, electricity and petroleum were all introduced gradually with little need for technological research.

In summary, the geopolitics of the empire, political conditions, and financial problems prevented the Ottoman state from concentrating on technological

research. In every field of transportation and communication, technicians were trained to meet immediate and practical needs, and theoretical research was neglected.

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